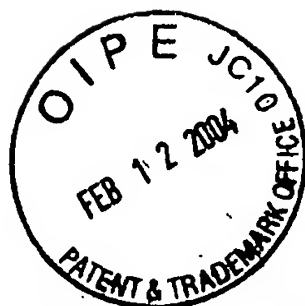


S/N 10/028643



PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant:	Kie Y. Ahn et al.	Examiner:	Long Pham
Serial No.:	10/028,643	Group Art Unit:	2814
Filed:	December 20, 2001	Docket:	1303.030US1
Title:	LOW-TEMPERATURE GROWN HIGH QUALITY ULTRA-THIN CoTiO <sub>3</sub> GATE DIELECTRICS		

---

**INFORMATION DISCLOSURE STATEMENT**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

In compliance with the duty imposed by 37 C.F.R. § 1.56, and in accordance with 37 C.F.R. §§ 1.97 *et. seq.*, the enclosed materials are brought to the attention of the Examiner for consideration in connection with the above-identified patent application. Applicants respectfully request that this Information Disclosure Statement be entered and the documents listed on the attached Form 1449 be considered by the Examiner and made of record. Pursuant to the provisions of MPEP 609, Applicants request that a copy of the 1449 form, initialed as being considered by the Examiner, be returned to the Applicants with the next official communication.

Pursuant to 37 C.F.R. §1.97(b), it is believed that no fee or statement is required with the Information Disclosure Statement. However, if an Office Action on the merits has been mailed, the Commissioner is hereby authorized to charge the required fees to Deposit Account No. 19-0743 in order to have this Information Disclosure Statement considered.

INFORMATION DISCLOSURE STATEMENT

Serial No :10/028643

Filing Date: December 20, 2001

Title: LOW-TEMPERATURE GROWN HIGH QUALITY ULTRA-THIN CoTiO<sub>3</sub> GATE DIELECTRICS

Page 2

Dkt: 1303.030US1

The Examiner is invited to contact the Applicants' Representative at the below-listed telephone number if there are any questions regarding this communication.

Respectfully submitted,

KIE Y. AHN ET AL.

By their Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.

P.O. Box 2938


Minneapolis, MN 55402

(612) 373-6944

Date

2-10-04

By



David C. Peterson

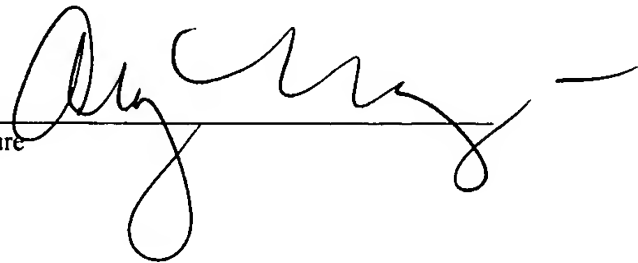
Reg. No. 47,857

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 10th day of February, 2004.

Name

Amy Moriarty

Signature



Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449A/PTO <b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> (Use as many sheets as necessary)	<i>Complete if Known</i>	
	<b>Application Number</b>	10/028,643
	<b>Filing Date</b>	December 20, 2001
	<b>First Named Inventor</b>	Ahn, Kie
	<b>Group Art Unit</b>	2814
	<b>Examiner Name</b>	Pham, Long
Sheet 1 of 4	Attorney Docket No: 1303.030US1	

US PATENT DOCUMENTS						
Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document	Class	Subclass	Filing Date If Appropriate
	US-2001/0002280	05/31/2001	Sneh, Ofer	427	255.28	12/22/2000
	US-2001/0009695 A1	07/26/2001	Saanila, Ville A., et al.	427	255.39	01/18/2001
	US-2001/0051442 A1	12/13/2001	Katsir, Dina , et al.	438	758	06/28/2001
	US-2001/0053082 A1	12/20/2001	Chipalkatti, Makarand H., et al.	362	496	12/22/1999
	US-2002/0001971	01/03/2002	Cho, Hag-ju	438	765	06/27/2001
	US-2002/0022156 A1	02/21/2002	Bright, Clark I.	428	698	08/24/2001
	US-2002/0119297	08/29/2002	Forrest, Stephen R., et al.	428	199	12/21/2001
	US-2002/0146916 A1	10/10/2002	Irino, Kiyoshi , et al.	438	785	03/29/2002
	US-2003/0001241 A1	01/02/2003	Chakrabarti, Utpal K., et al.	257	643	05/28/2002
	US-2003/0175411 A1	09/18/2003	Kodas, Toivo T., et al.	427	58	10/04/2002
	US-4,394,673	07/19/1983	Thompson, Richard D., et al.	357	15	09/29/1980
	US-5,055,319	10/08/1991	Bunshah, Rointan F., et al.	427	38	04/02/1990
	US-5,621,681	04/15/1997	Moon, Jong	365	145	03/22/1996
	US-5,744,374	04/28/1998	Moon, Jong	437	60	11/18/1996
	US-5,972,847	10/26/1999	Feenstra, Roeland , et al.	505	473	01/28/1998
	US-6,093,944	07/25/2003	VanDover, Robert B.	257	310	06/04/1998
	US-6,207,589	03/27/2001	Ma, Yanjun , et al.	438	785	02/29/2000
	US-6,232,847	05/15/2001	Marcy, 5th, Henry O., et al.	331	167	05/28/1998
	US-6,291,866	09/18/2001	Wallace, Robert M., et al.	257	410	10/20/1999

EXAMINER

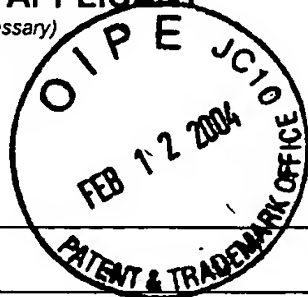
DATE CONSIDERED

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449A/PTO

**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**

(Use as many sheets as necessary)



Complete if Known

Application Number	10/028,643
Filing Date	December 20, 2001
First Named Inventor	Ahn, Kie
Group Art Unit	2814
Examiner Name	Pham, Long

Sheet 2 of 4

Attorney Docket No: 1303.030US1

	US-6,297,516	10/02/2001	Forrest, Stephen R., et al.	257	40	06/25/1999
	US-6,451,695	09/17/2002	Sneh, Ofer	438	685	12/22/2000
	US-6,602,338	08/05/2003	Chen, San-Yuan , et al.	106	287.19	04/11/2001

**FOREIGN PATENT DOCUMENTS**

Examiner Initials*	Foreign Document No	Publication Date	Name of Patentee or Applicant of cited Document	Class	Subclass	T <sup>2</sup>
-----------------------	---------------------	------------------	--	-------	----------	----------------

**OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS**

Examiner Initials*	Cite No <sup>1</sup>	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T <sup>2</sup>
		AARIK, JAAN , et al., "Influence of substrate temperature on atomic layer growth and properties of HfO/sub 2/ thin films", <u>Thin Solid Films</u> , 340(1-2), (1999),110-116	
		ALLEN, PETRA , "Atomic Layer deposition of Ta(Al)N(C) thin films using trimethylaluminum as a reducing agent", <u>Journal of the Electrochemical Society</u> , 148(10), (October 2001),G566-G571	
		BENDORAITIS, J G., et al., "Optical energy gaps in the monoclinic oxides of hafnium and zirconium and their solid solutions", <u>Journal of Physical Chemistry</u> , 69(10), (1965),3666-3667	
		CHAMBERS, J J., et al., "Physical and electrical characterization of ultrathin yttrium silicate insulators on silicon", <u>Journal of Applied Physics</u> , 90(2), (July 15, 2001),918-33	
		DUSCO, C , et al., "Deposition of tin oxide into porous silicon by atomic layer epitaxy", <u>Journal of the Electrochemical Society</u> , 143, (1996),683-687	
		EL-KAREH, B , et al., "The evolution of DRAM cell technology", <u>Solid State Technology</u> , 40(5), (1997),89-90, 92, 95-6, 98, 100-1	
		FORSGREN, K , <u>Comprehensive Summaries of Uppsala Dissertation from the Faculty of Science and Technology</u> , 665, (2001),37	
		GUILLAUMOT, B , et al., "75 nm damascene metal gate and high-k integration for advanced CMOS devices", <u>Technical Digest of International Electron Devices Meeting 2002</u> , (2002),355-358	
		GUTOWSKI, M J., "Thermodynamic stability of high-K dielectric metal oxides ZrO/sub 2/ and HfO/sub 2/ in contact with Si and SiO/sub 2/", <u>Applied Physics Letters</u> , 80(11), (March 18, 2002),1897-1899	
		JUNG, H S., et al., "Improved current performance of CMOSFETs with nitrogen incorporated HfO/sub 2/-Al/sub 2/O/sub 3/ laminate gate dielectric", <u>Technical Digest of International Electron Devices Meeting 2002</u> , (2002),853-856	
		KANG, L , et al., "MOSFET devices with polysilicon on single-layer HfO/sub 2/ high-K dielectrics", <u>International Electron Devices Meeting 2000. Technical Digest. IEDM</u> , (2000),35-8	
		KIM, Y. W., et al., "50nm gate length logic technology with 9-layer Cu	

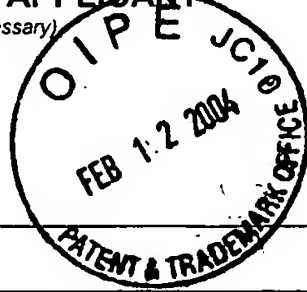
EXAMINER

DATE CONSIDERED

Substitute Disclosure Statement Form (PTO-1449)

\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

Substitute for form 1449A/PTO <b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> (Use as many sheets as necessary)	Complete if Known <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%;">Application Number</td> <td>10/028,643</td> </tr> <tr> <td>Filing Date</td> <td>December 20, 2001</td> </tr> <tr> <td>First Named Inventor</td> <td>Ahn, Kie</td> </tr> <tr> <td>Group Art Unit</td> <td>2814</td> </tr> <tr> <td>Examiner Name</td> <td>Pham, Long</td> </tr> </table>	Application Number	10/028,643	Filing Date	December 20, 2001	First Named Inventor	Ahn, Kie	Group Art Unit	2814	Examiner Name	Pham, Long
Application Number	10/028,643										
Filing Date	December 20, 2001										
First Named Inventor	Ahn, Kie										
Group Art Unit	2814										
Examiner Name	Pham, Long										
Sheet 3 of 4	Attorney Docket No: 1303.030US1										



OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No <sup>1</sup>	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T <sup>2</sup>
		interconnects for 90nm node SoC applications", <u>Technical Digest of International Electron Devices Meeting 2002</u> , (2002),69-72	
		KUKLI, K , et al., "Comparison of hafnium oxide films grown by atomic layer deposition from iodide and chloride precursors", <u>Thin Solid Films</u> , 416, (2002),72-79	
		KUKLI, KAUP0 , et al., "Influence of thickness and growth temperature on the properties of zirconium oxide films growth by atomic layer deposition on silicon", <u>Thin Solid Films</u> , 410(1-2), (2002),53-60	
		KUKLI, KAUP0 , et al., "Low-Temperature Deposition of Zirconium Oxide-Based Nanocrystalline Films by Alternate Supply of Zr[OC(CH3)3]4 and H2O", <u>Chemical Vapor Deposition</u> , 6(6), (2000),297-302	
		KUKLI, K J., et al., "Properties of hafnium oxide films grown by atomic layer deposition from hafnium tetraiodide and oxygen", <u>Journal of Applied Physics</u> , 92(10), (November 15, 2002),5698-5703	
		LEE, BYOUNG H., et al., "Characteristics of TaN gate MOSFET with ultrathin hafnium oxide (8 A-12 A)", <u>Electron Devices Meeting, 2000. IEDM Technical Digest. International</u> , (2000),39-42	
		LEE, S J., et al., "High quality ultra thin CVD HfO2 gate stack with poly-Si gate electrode", <u>Electron Devices Meeting, 2000. IEDM Technical Digest. International</u> , (2000),31-34	
		LEE, JUNG-HYOUNG , et al., "Mass production worthy HfO/sub 2/-Al/sub 2/O/sub 3/ laminate capacitor technology using Hf liquid precursor for sub-100 nm DRAMs", <u>Electron Devices Meeting, 2002. IEDM '02. Digest. International</u> , (2002),221-224	
		NAKAJIMA, ANRI , "Soft breakdown free atomic-layer-deposited silicon-nitride/SiO/sub 2/ stack gate dielectrics", <u>International Electron Devices Meeting. Technical Digest</u> , (2001),6.5.1-4	
		NIILISK, A , "Atomic-scale optical monitoring of the initial growth of TiO2 thin films", <u>Proceedings of the SPIE - The International Society for Optical Engineering</u> , 4318, (2001),72-77	
		OH, C B., et al., "Manufacturable embedded CMOS 6T-SRAM technology with high-k gate dielectric device for system-on-chip applications", <u>Technical Digest of International Electron Devices Meeting 2002</u> , (2002),423-426	
		PARK, JAEHOO , et al., "Chemical vapor deposition of HfO/sub 2/ thin films using a novel carbon-free precursor: characterization of the interface with the silicon substrate", <u>Journal of the Electrochemical Society</u> , 149(1), (2002),G89-G94	
		POVESHCHENKO, V P., et al., "Investigation of the phas composition of films of zirconium, hafnium and yttrium oxides", <u>Soviet Journal of Optical Technology</u> , 51(5), (1984),277-279	
		RAHTU, ANTTI , et al., "Atomic Layer Deposition of Zirconium Titanium Oxide	

EXAMINER

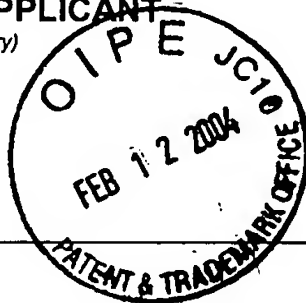
DATE CONSIDERED

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449A/PTO

**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**

(Use as many sheets as necessary)



Complete if Known

Application Number 10/028,643

Filing Date December 20, 2001

First Named Inventor Ahn, Kie

Group Art Unit 2814

Examiner Name Pham, Long

Sheet 4 of 4

Attorney Docket No: 1303.030US1

**OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS**

Examiner Initials*	Cite No <sup>1</sup>	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T <sup>2</sup>
		from Titanium Isopropoxide and Zirconium Chloride", <u>Chemistry of Materials</u> , 13(5), (May 2001), 1528-1532	
		ROBERTSON, J. , "Band offsets of wide-band-gap oxides and implications for future electronic devices", <u>Journal of Vacuum Science &amp; Technology B</u> (Microelectronics and Nanometer Structures), 18(3), (May-June 2000), 1785- 1791	
		ROSSNAGEL, S M., et al., "Plasma-enhanced atomic layer deposition of Ta and Ti for Interconnect diffusion barriers", <u>Journal of Vacuum Science &amp; Technology</u> <u>B (Microelectronics and Nanometer Structures)</u> , 18(4), (July 2000), 2016-2020	
		TAVEL, B , et al., "High performance 40 nm nMOSFETs with HfO/sub 2/ gate dielectric and polysilicon damascene gate", <u>Technical Digest of International</u> <u>Electron Devices Meetings 2002</u> , (2002), 429-432	
		VAN DOVER, R B., et al., "Deposition of Uniform Zr-Sn-Ti-O Films by On-Axis Reactive Sputtering", <u>IEEE Electron Device Letters</u> , 19(9), (September 1998), 329 - 331	
		WOLF, S. , et al., <u>In: Silicon Processing of the VLSI Era, Vol. 1</u> , Lattice Press, 374-380	
		WOLFRAM, G , et al., "Existence range, structural and dielectric properties of ZrxTiySnzO4 ceramics (x + y = 2)", <u>Materials Research Bulletin</u> , 16(11), (November 1981), 1455-63	

**EXAMINER****DATE CONSIDERED**

Substitute Disclosure Statement Form (PTO-1449)

\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 809. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached